

In the Claims:

Please cancel claims 1-26 and add the following claims for consideration:

--27. A composite grating, comprising:

(a) an active material; and

(b) an ordered assemblage of subgratings supported by the active material for receiving input pulses along an input path and transmitting output pulses along an output path, wherein

(1) each subgrating satisfies one of (i) the Bragg condition and (ii) the superficial grating condition so as to diffract a respective subbandwidth of light from the input path to the output path, and

(2) the subgratings are configured such that (i) a first input optical pulse, interacting with the active material along the input path and having a first prescribed input temporal waveform, triggers an output optical pulse having a prescribed output temporal waveform and propagating along the output path, and (ii) a second input optical pulse, interacting with the active material along the input path and having a second prescribed temporal waveform different from the first prescribed temporal waveform, does not trigger an output optical pulse having the prescribed output temporal waveform and propagating along the output path.

28. The composite grating of claim 27 wherein the input path and the output path are at least partly coextensive.

29. The composite grating of claim 28 wherein the input pulses are received along the input path in an input direction and the output pulses are transmitted along the output path in a direction opposite to the input direction.

30. The composite grating of claim 27 wherein the prescribed output temporal waveform is a substantially temporally brief pulse.

31. The composite grating of claim 27 wherein the prescribed output temporal waveform is substantially an auto-correlation spike.

32. The composite grating of claim 31 wherein the second prescribed temporal waveform is sufficiently orthogonal under cross correlation with the first prescribed temporal waveform as to produce substantially no spike from the composite grating when received thereby.

33. The composite grating of claim 27 wherein the subgratings are supported within a volume of the active material, each respective subgrating satisfying the Bragg condition for the respective subbandwidth of light and the input path and the output path.

34. The composite grating of claim 27 wherein the subgratings are supported on a surface of the active material, each respective subgrating satisfying the superficial grating condition for the respective subbandwidth of light and the input path and the output path.

35. The composite grating of claim 27 wherein the subgratings comprise spatial variations in the refractive index of the active material.

36. The composite grating of claim 27 wherein the active material is a non-frequency-selective material.

37. An optical waveform detector comprising:

(a) a detector capable of detecting light pulses having a prescribed detectable temporal waveform;

(b) a composite grating for receiving light pulses along an input path and transmitting light pulses to the detector along an output path, the composite grating comprising:

(1) an active material:

(2) an ordered assemblage of subgratings supported by the active material, wherein

(i) each respective subgrating satisfies at least one of the Bragg condition and the superficial grating condition so as to diffract a respective subbandwidth of light from the input path to the output path,

and

(ii) the subgratings are so configured such that an input optical pulse interacting with the active material along the input path and having a prescribed input temporal waveform triggers an output optical pulse along the output path having the prescribed detectable temporal waveform, the prescribed detectable temporal waveform being different from the prescribed input temporal waveform.

38. The optical waveform detector of claim 37 wherein the subgratings are supported within a volume of the active material, each respective subgrating satisfying the Bragg condition for the respective subbandwidth of light and the input path and the output path.

39. The optical waveform detector of claim 37 wherein the subgratings are supported on a surface of the active material, each respective subgrating satisfying the superficial grating condition for the respective subbandwidth of light and the input path and the output path.

40. The optical waveform detector of claim 37 wherein the input path and the output path are at least partially coextensive and wherein the input pulses travel to the composite grating in an input direction and the output pulses leave the composite grating in a direction opposite to the input direction.

41. The optical waveform detector of claim 37 wherein the subgratings comprise spatial variations in the refractive index of the active material.

42. The optical waveform detector of claim 37 wherein the active material is a non-frequency-selective material.

43. A communications system comprising:

(a) a source of optical data, the data comprising optical light pulses, each pulse having one of a set of specific temporal waveforms;

(b) a detector capable of detecting an optical pulse having a prescribed detectable temporal waveform different from each of the set of specific temporal waveforms;

(c) a composite grating arranged to receive the light pulses from the source and to transmit, in response thereto, output light pulses along an output path to the detector, the grating comprising an ordered assemblage of subgratings supported by an active material, wherein

(1) each respective subgrating satisfies at least one of the Bragg condition and the superficial grating condition so as to diffract a respective subbandwidth of light from the source to the output path, and

(2) the subgratings are so configured such that

(i) an optical pulse received from the source, interacting with the active material and having a prescribed one of the set of specific temporal waveforms, triggers an output optical pulse along the output path having the prescribed detectable temporal waveform, and

(ii) an optical pulse received from the source, interacting with the active material along the input path and having one of the set of specific temporal waveforms other than the prescribed one, does not trigger an output optical pulse along the output path having the prescribed detectable temporal waveform.

44. An optical-waveform-sensitive routing system comprising:

(a) a router responsive to change the routing of data in response to an optical pulse having a prescribed detectable temporal waveform;

(b) a composite grating for receiving input light pulses along an input path and transmitting, in response thereto, output light pulses to the router along an output path, the grating comprising an ordered assemblage of subgratings supported by an active material wherein

(1) each respective subgrating satisfies at least one of (i) the Bragg condition and (ii) the superficial grating condition so as to diffract a respective subbandwidth of light from the input path to the output path, and

(2) the subgratings are so configured such that an optical pulse received by the composite grating, interacting with the active material along the input path and having a prescribed input temporal waveform different from the prescribed detectable temporal waveform, triggers an

output optical pulse along the output path having the prescribed detectable temporal waveform.

45. A composite grating for receiving light along an input path and transmitting light along an output path, the composite grating comprising:

- (a) a non-frequency-selective active material;
- (b) an ordered assemblage of subgratings supported by the active material; wherein

- (1) each respective subgrating satisfies at least one of (i) the Bragg condition and (ii) the superficial grating condition so as to diffract a respective subbandwidth of light from the input path to the output path, and

- (2) the subgratings are so configured such that an input optical pulse interacting with the active material along the input path and having a prescribed input temporal waveform triggers an output optical pulse along the output path having a prescribed output temporal waveform, the prescribed output temporal waveform being different from the prescribed input temporal waveform.

46. The composite grating of claim 45 wherein the input path and the output path are at least partly coextensive.

47. The composite grating of claim 46 wherein the input pulses are received along the input path in an input direction and the output pulses are transmitted along the output path in a direction opposite to the input direction.

48. The composite grating of claim 45 wherein the prescribed output temporal waveform is a substantially temporally brief pulse.

49. The composite grating of claim 45 wherein the subgratings are supported within a volume of the active material, each respective subgrating satisfying the Bragg condition for the respective subbandwidth of light and the input path and the output path.